Working Papers in Southwestern
Ponderosa Pine Forest Restoration

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Integrating Forest Restoration Treatments with Mexican Spotted Owl Habitat Needs

September 2005

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Ecological restoration seeks to heal degraded ecosystems by reestablishing native species, structural characteristics, and ecological processes. The Society for Ecological Restoration International defines restoration as "an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability. . . . Restoration attempts to return an ecosystem to its historic trajectory" (Society for Ecological Restoration International 2004).

In the southwestern United States, most ponderosa pine forests have been degraded during the last 150 years; many areas are now dominated by dense thickets of small trees and have lost their once diverse understory. Forests in this condition are highly susceptible to damaging, stand-replacing fires and increased insect and disease epidemics. Restoration of these forests centers on reintroducing frequent, low-intensity surface fires—often after first thinning dense stands—and reestablishing productive understory plant communities. The Ecological Restoration Institute at Northern Arizona University is a pioneer in researching, implementing, and monitoring ecological restoration of southwestern ponderosa pine forests. By allowing natural processes such as fire to resume self-sustaining patterns, we hope to reestablish healthy forests that provide ecosystem services, wildlife habitat, and recreational opportunities.

Every restoration project needs to be site specific, but the detailed experience of field practitioners may help guide practitioners elsewhere. The Working Papers series presents findings and management recommendations from research and observations by the ERI and its partner organizations.

This publication would not have been possible without funding from the USDA Forest Service. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Government. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Government.

Executive Summary

Management of the federally threatened Mexican spotted owl (MSO; *Strix occidentalis lucida*) has been a major concern, both technical and political, for forest managers in the southwestern United States. So has the need to reduce the risk of stand-replacing wildfire in the region's ponderosa pine forests. Managers have generally shied away from linking these two concerns, fearing that the consultation required under the federal Endangered Species Act makes forest restoration treatments in or adjacent to MSO habitat too cumbersome.

Yet carefully planned and implemented restoration treatments either around or in MSO habitat are crucial to the species' future survival, and can be accomplished. They can be designed to maximize benefits to forest health while minimizing negative impacts to—and in some cases actively benefiting—the MSO and/or its habitat. There will never be 100 percent agreement between reducing fire risk and maintaining or enhancing MSO habitat needs, but the goal of this publication is to find the areas of common ground between these two important management priorities within southwestern forests.

Species Status

- MSOs occur in the southwestern states in disjunct forested mountain systems, moist canyons, and in some areas in steep, rocky canyonlands.
- In forested habitats, MSOs tend to prefer areas of fairly dense forest with high canopy cover.
- In the past MSOs likely lived in patches of suitable habitat set in a matrix of more open ponderosa pine forests.
- The MSO is a federally listed threatened species, and managers are legally mandated to consider its needs in management actions.
- Managers have often shied away from restoration treatments in or near MSO habitat because of perceived legal and bureaucratic hurdles.
- Monitoring has been insufficient to accurately determine MSO population trends.
- Research shows that MSO recruitment levels vary a great deal, and as a result the species is vulnerable to factors that increase adult mortality.
- High-severity wildfire is one of the primary threats to the MSO.
- Effects of fire on MSOs can be mixed, and can range from outright habitat destruction to increases in prey base.

Recommendations

- It is important to consider fuel reduction and restoration treatments both in MSO habitat—usually pine-oak or mixed conifer stands—and in the surrounding ponderosa pine forest matrix.
- Managers can conduct restoration treatments in much MSO habitat according to criteria established in the MSO Recovery Plan.
- Such treatments are necessary in order to protect MSO habitat and other areas from severe fire and to improve forest health, and they can be accomplished through careful planning.
- Managers should conduct restoration treatments in ponderosa pine forests around MSO habitat in order to protect those habitats, reduce the risk of large-scale wildfire, and increase forest health.

Introduction

Key Points

- Managers have often shied away from forest restoration treatments in or near Mexican spotted owl habitat because of perceived legal and bureaucratic hurdles.
- Such treatments are necessary in order to protect MSO habitat and other areas from severe fire and to improve forest health, and they can be accomplished through careful planning.

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Yet carefully planned and implemented restoration treatments either around or in MSO habitat are crucial to the species' future survival, and can be accomplished. They can be designed to maximize benefits to forest health while minimizing negative impacts to—and in some cases actively benefiting—the MSO and/or its habitat. There will never be 100 percent agreement between reducing fire risk and maintaining or enhancing MSO habitat needs, but the goal of this publication is to find the areas of common ground between these two important management priorities within southwestern forests.

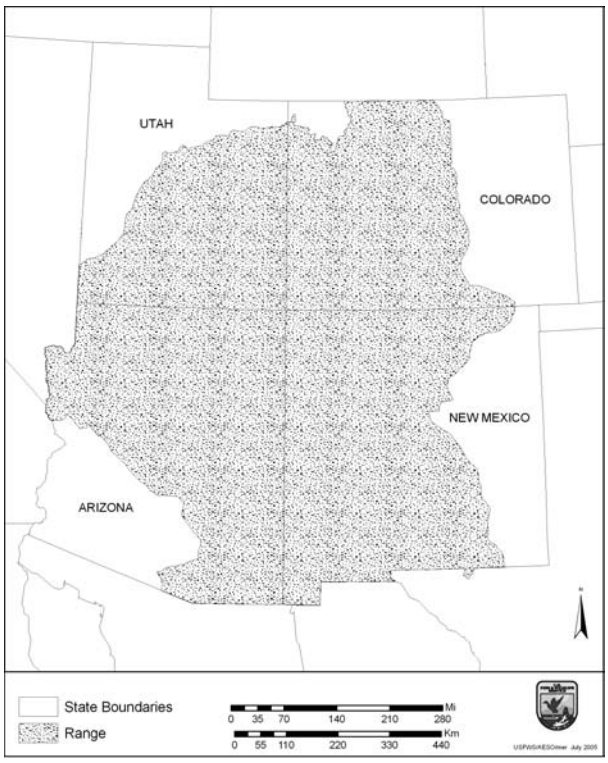

Figure 1. Mexican spotted owl range in the southwestern United States. Map courtesy of U.S. Fish and Wildlife Service.

Mexican Spotted Owl Biology

Key Points

- MSOs occur in the southwestern states in disjunct forested mountain systems, moist canyons, and in some areas in steep, rocky canyonlands.
- In forested habitats, MSOs tend to prefer areas of fairly dense forest with high canopy cover.

Because of its close association with commercially valuable forests in western North America, the spotted owl is one of the most studied birds in the world (Gutiérrez et al. 1995). The Mexican spotted owl is one of three recognized subspecies. It is separated geographically from both the northern and California spotted owls of the west coast and has been genetically isolated from them for thousands of years (Barrowclough et al. 1999).

The MSO occupies a broad range in the southwestern United States (Figure 1), but it does not occur uniformly within this area. Instead, it occurs in disjunct forested mountain systems, moist canyons, and in some cases in steep, rocky canyonlands. The current distribution is believed to be similar to its historical distribution, with the exception that the species has not been regularly reported since before its listing, in 1993, along major riparian corridors in Arizona, New Mexico, and Mexico, nor in the forests along the Colorado Front Range (Ward et al. 1995).

The MSO nests, roosts, forages, and disperses in a variety of habitats. Mixed conifer forests are commonly used throughout most of the range. In general, these forests are dominated by Douglas-fir and/or white fir, with codominant species including southwestern white pine, limber pine, and ponderosa pine (Ganey and Dick 1995). Along the Mogollon Rim in Arizona and New Mexico, MSO nest in mixed conifer and ponderosa pine–Gambel oak forests, as well as rocky canyons (Ganey and Dick 1995; May and Gutiérrez 2002). South of the Mogollon Rim and into Mexico, a still wider variety of habitats are used, including mixed conifer, Madrean pine-oak, and Arizona cypress forests, encinal oak woodlands, and associated riparian forests (Ganey and Dick 1995). MSOs generally do not nest in pure stands of ponderosa pine (Ganey and Dick 1995).

Nesting most commonly occurs in closed-canopy forests or rocky canyons. Nests are often located in tree cavities or dwarf mistletoe brooms, but are also placed in caves or cliff ledges in steep-walled canyons in northern Arizona and southern Utah and Colorado. Within forested habitat, MSO show a strong preference for closed-canopy stands with a high basal area (Ganey and Dick 1995; Seamans and Gutiérrez 1995). Such stands may provide a more moderate microclimate during the day, as well as greater concealment from avian predators for both roosting adults and young near the nest (Ganey 2004; USFWS 1995). In pine-oak habitat, researchers have found that mature Gambel oak trees are extremely important as nest sites (May and Gutiérrez 2002; Seamans et al. 1999), and may also provide food and nest site resources for owl prey.

In ponderosa pine–Gambel oak habitat south of Flagstaff, Ganey et al. (1999) found that 75 percent of owl use was in stands with canopy cover of greater than 40 percent. Owls did not roost in stands with canopy cover of less than 25 percent. In mixed conifer forests on the Coconino National Forest, owls selected areas characterized by canopy closures of 55 percent or more (May and Gutiérrez 2002). In the Sacramento Mountains of New Mexico, Ganey et al. (2003) found that all but two roosting stands in mixed conifer forests had canopy cover greater than 40 percent, and 75 percent of stands used for roosting had canopy cover greater than 60 percent.

MSO use a much wider variety of habitat types for foraging than for nesting or roosting. Year-round residents often use larger ranges during the nonbreeding season than during the breeding season, and some owls appear to shift their habitat entirely in winter. Seasonal movements of up to 30 miles have been recorded from pine-oak and mixed conifer habitats to lower elevations, including piñon-juniper woodlands and even the interface between such woodlands and desert scrub (Ganey and Block 2005).

The sizes of individual home ranges—or the areas used by individual animals during their normal activities—vary considerably among habitats (USFWS 1995). Home range sizes recorded during several radio-telemetry studies have varied from 645 to 3,672 acres for individuals and 941 to 3,831 acres for pairs (Ganey et al. 1999; USFWS 1995; Willey 1998). Annual home range sizes for owls in pine-oak forests and in the canyonlands of southern Utah are among the largest recorded.

Mexican Spotted Owls and Historical Forest Conditions

Key Points

- In the past MSOs likely lived in patches of suitable habitat set in a matrix of more open ponderosa pine forests.
- It is important to consider fuel reduction and restoration treatments both in MSO habitat—usually pine-oak or mixed conifer stands—and in the surrounding ponderosa pine forest matrix.

Reconstruction of historical forest conditions through dendrochronology, historic accounts, and other methods has shown that many southwestern ponderosa pine forests were relatively open before the onset of large-scale logging, livestock grazing, and fire exclusion (Covington and Moore 1994; Covington 2003). How did a species that relies largely on dense forest stands survive in these conditions? It is likely that MSO nested and roosted in relatively dense stands of mixed conifer, pine-oak, and riparian forest embedded within a matrix of more open-structured pine forest (Ganey and Dick 1995; Ganey et al. 1999; Beier and Maschinski 2003). Many of these areas, such as north-facing slopes and moist canyons, may have been able to avoid most of the frequent surface fires that maintained open stands of ponderosa pine, and could have developed into closed-canopy forests subject to a stand-replacing but highly infrequent fire regime. In addition, MSO probably occurred in pine-oak stands that may have had a fairly open structure of ponderosa pines but also a significant Gambel oak component, such as those documented at Camp Navajo in northern Arizona (Fulé et al. 1997). Other habitats once used by MSO, in particular lower-elevation riparian areas, have been lost to the species because of human development and extreme habitat alterations (Ganey and Dick 1995).

Many of these forested areas are today at increased risk of severe wildfire both because of increased tree density within them and because of the greatly increased severity of fires that originate in the surrounding ponderosa pine matrix and enter mixed conifer or pine-oak MSO habitat as crown fires (Jenness et al. 2004). Reduction of fire risk both within and outside MSO habitat, then, is important to the species' continuing viability.

However, reducing fire risk cannot be the only goal in managing these forests. Relatively dense reserve areas suitable for MSO nesting and roosting are crucial to the survival of the species (Ganey et al. 1999). Some pine-oak stands have changed substantially since the onset of Euro-American settlement (Ruess 1995; Fulé et al. 1997). Regardless whether they functioned as MSO habitat prior to Euro-American settlement of the region, some such stands provide nesting and/or foraging habitat for MSO today. They may compensate, in part, for the loss of MSO habitat elements elsewhere within the species' range.

Managing such areas for conservation of the MSO, as required by the Endangered Species Act, requires careful balancing with restoration needs; rather than attempting to restore them to presettlement conditions, it may often be more appropriate to attempt to secure them from severe wildfire by restoring adjoining ponderosa pine forest areas (Brown et al. 2004).

Legal Status

Key Point

- The MSO is a federally listed threatened species, and managers are legally mandated to consider its needs in management actions.

The MSO was federally listed as a threatened species by the U.S. Fish and Wildlife Service (USFWS) in 1993 (USFWS 1993). Even-aged timber harvest and catastrophic fire were identified as the primary threats to the species, with grazing, recreation, and other land-use practices listed as additional threats. A Recovery Plan was finalized in December 1995; as of this printing, it is being reviewed and revised.

Critical habitat for the MSO has been proposed and finalized three times as a result of legal challenges and subsequent court rulings. The most recent designation was finalized on August 31, 2004, and designated approximately 8.6 million acres of potential critical habitat in Arizona, New Mexico, Utah, and Colorado (USFWS 2004c). Within this larger region, critical habitat is limited to areas that meet the following definitions:

- *Protected Habitat* includes all known owl sites and all areas within mixed conifer or pine-oak habitat with slopes greater than 40 percent where timber harvest has not occurred in the past 20 years.
- *Restricted Habitat*, encompassing habitat not known to be currently occupied by nesting owls but potentially suitable, includes mixed conifer forest, pine-oak forest, and riparian areas outside of Protected Habitat.

- *Protected Activity Centers* (PACs) are core 600-acre areas designated around nest sites within Protected Habitat areas, with an additional 100-acre center area identified around nest sites.

Critical habitat is further characterized by the presence of primary constituent elements, or landscape features that fulfill habitat needs for nesting, roosting, foraging, or dispersal. Elements relating both to habitat structure and prey availability were defined for both forest and canyon areas. For forested areas, they include the following forest structural qualities:

- A range of tree species, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different ages of trees, 30 to 45 percent of which are large trees with diameter at breast height (dbh) of 12 inches or more.
- A shade canopy created by the tree branches covering 40 percent or more of the ground.
- Large snags with a dbh of at least 12 inches.

Primary constituent elements related to the maintenance of adequate prey species include:

- High volumes of fallen trees and other woody debris.
- A wide range of tree and plant species, including hardwoods.
- Adequate levels of residual plant cover to maintain fruits and seeds and allow plant regeneration.

Population Numbers and Current Trends

Key Points

- Monitoring has been insufficient to accurately determine MSO population trends.
- Research shows that MSO recruitment levels vary a great deal, and as a result the species is vulnerable to factors that increase adult mortality.

Although the MSO is listed as a threatened species, a reliable estimate of numbers of owls throughout its range is not currently available, and the quality and quantity of information regarding numbers of MSO varies by source. It is clear that the great majority of individuals in the U.S. live on lands administered by Region 3 of the Forest Service (Arizona and New Mexico); 91 percent of MSO locations recorded from 1991 to 1993 were on these lands (USFWS 1995).

Population estimates from a variety of surveys include the following:

- 2,074 individuals in Arizona and New Mexico (Fletcher and Hollis 1994)
- 2,160 individuals throughout U. S. range (USFWS 1991)
- 2,941 individuals in Upper Gila Mountains Recovery Unit (Ganey et al. 2004), though this estimate included an uncertainty (SE) of plus or minus 1,075 individuals
- 987 PACs (supporting 987 to 1,960 individuals) in Forest Service Region 3 (USFWS 2004a)
- 12 PACs (12 to 24 individuals) in Colorado and 105 (105 to 210 individuals) in Utah (USFWS 2004b)
- 41 PACs in Grand Canyon National Park (pers. comm., R. V. Ward, Grand Canyon National Park, 2004)

A reliable estimate of the amount of MSO habitat in the U.S. is unavailable, but regional habitat mapping exercises conducted in 2001 identified approximately 6.6 million acres of MSO habitat on National Forest lands in Arizona and New Mexico (USFWS 2004b). This figure included 588,000 acres in PACs, 2.1 million acres of other Protected Habitat, and 3.9 million acres of Restricted Habitat. The USFWS considers estimates of PAC numbers and habitat acres on other public lands to be deficient (USFWS 2004b).

The trends this population is undergoing are uncertain, as no range-wide population monitoring has been done. A study of MSO population dynamics was undertaken by researchers in one study area (encompassing 63 territories) in Arizona and one area (47 territories) in New Mexico from 1991 through 2002. The initial publication of the findings reported that both study populations were declining at 10 percent a year or more, and that owl survival rates in Arizona may be declining over time (Seamans et al. 1999). Reduced habitat quality and regional trends in climate were cited as two possible reasons for these declines. The final report found that owl reproduction varied greatly over time, while survival varied little (Gutiérrez et al. 2003). The Arizona population was considered stable, while that in New Mexico declined at an annual rate of about 6 percent. The study concluded that MSO can experience great annual fluctuations in numbers due to high annual variation in recruitment. That variability makes the species quite vulnerable to factors that reduce adult survival during years of low recruitment (USFWS 2004b).

Wildfire and Mexican Spotted Owl Habitat

Key Points

- High-severity wildfire is one of the primary threats to the MSO.
- Effects of fire on MSOs can be mixed, and can range from habitat destruction to increases in prey base.

The MSO Recovery Plan (USFWS 1995) cites high-severity wildfire as one of the primary threats to the species and its habitat in nearly all recovery units. The USFWS (2004a) reported that stand-replacing fires have affected hundreds of thousands of acres of MSO habitat in the Southwest since 1996. In 2002 the 462,384-acre Rodeo-Chediski Fire burned through approximately 55 PACs on the Tonto and Apache-Sitgreaves national forests and the White Mountain Apache Reservation. Of the 11,986 acres of PAC habitat that burned on national forest lands, approximately 55 percent burned at moderate to high severity (USFWS 2004b), meaning that burned trees either retained some needles or were completely dead. Based on fire severity maps, the FWS estimates that tribal and private lands in this wildfire likely burned in a similar fashion. Table 1 lists the effects of a number of recent large fires on MSO PACs.

Current trends in both forest ecology and climate change suggest that fires in the western United States may continue to become more frequent and more severe, threatening the viability of species that rely on relatively dense forest stands (McKenzie et al. 2004). The combination of severe, unnaturally intense wildfires with the cumulative effects of other human-caused changes to MSO habitat—such as logging, livestock grazing, habitat loss, and recreation—represents a serious threat to the species' continued viability.

Table 1. Recent influential fires within the Upper Gila Mountains Recovery Unit (USFWS 2004b).

Fire Name	Year	Total Acres Burned	# PACs Burned	# PAC Acres Burned
Rhett Prescribed Natural Fire	1995	20,938	7	3,698
Pot	1996	5,834	4	1,225
Hochderffer	1996	16,580	1	190
BS Canyon	1998	7,000	13	4,046
Pumpkin	2000	13,158	4	1,486
Rodeo-Chediski	2002	462,384	55	~33,000
TOTAL		**525,894**	**84**	**~43,645**

Specific information about the impact of wildfire on MSO habitat is limited due to lack of empirical information, including pre-wildfire surveys; refined mapping tools to determine the variable impacts of wildfire on important habitat components; and post-wildfire monitoring of vegetation, prey species, and owls themselves. It is also difficult to assess fire impacts on habitat because they can be exacerbated by human responses to fire, especially fire suppression and timber salvage activities.

Effects of Fire

In some cases fire burns severely enough to kill trees used for nesting and roosting, altering habitat to such a degree that it is no longer suitable for MSO. Yet spotted owls have high site fidelity, and individuals may remain in their historically used core home range even as the habitat in it becomes less suitable (Forsman et al. 1984). They become more vulnerable to predators due to lack of cover, and are less likely to reproduce successfully if nesting and prey habitat have been degraded. Fires, whether prescribed or naturally ignited, can also destroy snags and downed woody debris (Randall-Parker and Miller 2002), thereby degrading habitat conditions for MSO prey species in the short term.

In many cases wildfires burn in a mosaic of severity levels and may actually improve overall habitat conditions for the MSO in the short term. The improvement in habitat conditions comes in the form of increased vegetative diversity and initial herbaceous growth, if precipitation allows, which in turn can result in increased prey densities, thereby providing a short-term benefit to MSO (Bond et al. 2002). Jenness et al. (2004) monitored MSO habitat sites within four years after fires in Arizona and New Mexico and found no large differences in site occupancy and reproduction between burned and unburned areas. In the long term, though, fires burning at a high level of severity represent a major departure from the natural range of variability of most southwestern forests, and represent a significant threat to the continued viability of the MSO (Jenness et al. 2004). A modeling effort focused on California spotted owls (*S. o. occidentalis*) concluded that potential high-intensity fire represents a larger risk, in the long term, to this subspecies' persistence than mechanical thinning intended to reduce fire risks (Lee and Irwin 2005); the same is probably true for MSO.

Effects of Fire Suppression and Post-Fire Response

The impact of fire suppression activities on habitat quality can, in some cases, exceed that of the fire itself (Backer et al. 2004). Backfires may char MSO habitat. Low-flying aircraft dropping water or retardant may result in disturbance or injury. Bulldozer lines compact the soil and may cause erosion, which in turn can affect the quality of MSO nesting and foraging habitat. Dozer lines can easily become avenues for recreational vehicle access, and hand lines can result in hiker and mountain bike disturbance to nesting owls. Invasive or noxious weed species transported on the wheels of heavy equipment can affect the foraging success and abundance of prey species.

Post-fire salvage treatments can also affect MSO habitat. The long-term effects of salvage logging on MSO have not been studied, but Beschta et al. (2004) state that post-fire treatments, such as salvage logging, livestock grazing, and seeding of exotic species, can further alter succession and

Case Study: Woody Ridge Forest Restoration Project, Coconino National Forest

The Woody Ridge Forest Restoration Project is underway on 31,000 acres southwest of Flagstaff, Arizona, in an area immediately adjacent to various subdivision communities and other private, county, city, and federal facilities. Objectives of the project include restoration of forest health and decreasing the potential for stand-replacing wildfire. Project activities include mechanical thinning and broadcast burning of ponderosa pine–Gambel oak forest. Thinning treatments fall into three categories:

- fuels reduction with a fire risk reduction emphasis;
- fuels reduction adjusted to maintain habitat for MSO, northern goshawk, wild turkey, and black bear;
- fuels reduction with an emphasis on American pronghorn habitat.

Other project activities include road obliteration and closure and construction of non-motorized trails.

Four MSO PACs fall entirely or partially within the project area. The project follows Recovery Plan recommendations and Forest Plan standards and guidelines for fuel reduction treatments within MSO Protected and Restricted Habitat. Thinning of trees under 9 inches dbh and prescribed burning will take place within MSO PACs. Restricted Habitat will be thinned from below using prescriptions that maintain moderate to high canopy closure (40 to 60 percent), and patches or clumps of up to four acres in size. In Restricted Habitat with a wildfire risk reduction emphasis, canopy closure will be maintained at 30 to 40 percent, and canopy layers will be reduced. In order to mitigate the loss of large logs during burning, the Forest Service will create replacement logs in Restricted Habitat by leaving some trees 12 to 18 inches dbh cut and on the ground to replace those lost during the first prescribed fire after thinning.

This project had consistent input from the USFWS during the planning phase, and consultation was completed informally within 60 days of receipt of the Biological Assessment.

delay restoration of sites by degrading nesting and foraging habitat, and can exacerbate the damage that may have resulted to soils from fire.

Forest Restoration and Mexican Spotted Owl Habitat

Key Points

- Managers can conduct restoration treatments in much MSO habitat according to criteria established in the MSO Recovery Plan.
- Managers should conduct restoration treatments in ponderosa pine forests around MSO habitat in order to protect those habitats, reduce the risk of large-scale wildfire, and increase forest health.

Unlike simple fuels treatments aimed at reducing fire risks, comprehensive restoration treatments look beyond immediate societal demands to critical ecological processes (see *Working Paper 4: Fuels Treatments and Forest Restoration: An Analysis of Benefits*). They require an integrated, multi-disciplinary approach that is rooted in conservation biology and that combines the protection of intact, healthy landscapes with active restoration of degraded areas (DellaSala et al. 2003). They can incorporate management activities ranging from allowing lightning-ignited fires to burn, to thinning treatments that remove a significant percentage of living trees. Regardless of the tactics used, wildlife and understory vegetation are integral parts of the forest ecosystem and must be considered when planning and implementing restoration treatments.

Not all areas occupied by MSO have the same restoration needs. Active thinning and prescribed fire treatments can contribute toward the restoration of ecological structures and functions, and are needed in many places. But they are not needed everywhere. In some places natural fire can serve the same purpose, especially in designated wilderness areas, forest tracts well outside the wildland-urban interface, and other areas where topography allows (Kauffman 2004). In such areas land managers can write plans for the management of natural fires. If MSO habitat is present in a given area, consultation with the USFWS is necessary in the writing of such plans. Completion of the legally required National Environmental Policy Act (NEPA) documentation and Section 7 consultation are integral to the planning process.

The Recovery Plan makes precise recommendations for restoration treatments in MSO Protected and Restricted Habitat (**http://endangered.fws.gov/i/B6V.html**). These recommendations are an excellent starting point. In some cases managers may want to diverge from them in order to meet a specified goal. Consultation with the USFWS (see below) is the key to diverging from Recovery Plan specifications.

In addition, managers should prioritize restoration treatments around designated MSO habitat areas (Ganey et al. 1999) to promote overall forest health, reduce fire risk to human communities, and minimize fire threats to MSO habitat. Most ponderosa pine forests without a large oak component do not support breeding MSO, and these areas are also often most in need of restoration treatments. Such tracts offer prime opportunities for returning to self-sustaining ecological conditions in which frequent, low-intensity fires maintain open stands and minimize risks of severe fire (see *Working Paper 9: Restoration of Southwestern Ponderosa Pine Forests to Presettlement Conditions*).

Restoration treatments undertaken in pure ponderosa pine stands should consider impacts to nearby known MSO habitats. They can improve MSO habitat conditions by promoting the growth of a healthy herbaceous understory and by incorporating occasional denser stands, especially along the edges of treatment areas. These areas of denser canopy can be juxtaposed in such a way as to reduce the risk of spreading fire between the canopies. Slash treatment should seek a balance between reducing the risk of stand-replacing fire while still allowing the retention of sufficient woody debris to provide prey habitat and help protect soils from erosion. Many MSO nesting and roosting areas will inevitably remain susceptible to fire by virtue of their density, but reducing crown fire risks in the ponderosa pine landscape around them will reduce the risk that high-severity fire will travel into them from outside.

Treatment Recommendations

Each restoration treatment should be site-specific, but in general following these recommendations will protect MSO habitat attributes while reducing fire risk and restoring forest health to MSO habitats and adjacent areas.

Around Protected and Restricted Habitat

- In ponderosa pine forests around MSO habitat, conduct restoration treatments of sufficient size and intensity to reduce the risk that high-severity fire will enter MSO habitat from the surrounding matrix.
- Where possible, prioritize treatments so that they reduce wildfire risks in designated MSO habitat, such as in areas upwind of or topographically below MSO habitat.

In Protected and Restricted Habitat

- Follow the recommendations of the MSO Recovery Plan (USFWS 1995) for treatments in pine-oak and mixed conifer Protected and Restricted Habitat.
- Determine if Gambel oak is present in the project area and vicinity by on-site surveys, as its presence can be difficult to detect by traditional classification procedures and current remote-sensing equipment (May and Gutiérrez 2002); determine if the amount of oak meets the Recovery Plan definition for pine-oak habitat.
- If Restricted or Protected Habitat is present, survey for MSO within and immediately adjacent to the project area according to the recommended USFWS protocol.
- Don't cut trees over 24 inches dbh in Restricted Habitat.
- Minimize harvest of, damage to, and fire loss of large trees over 18 inches dbh in Restricted Habitat.
- Protect large oak trees from all project activities and from woodcutters (Seamans et al. 1999; May and Gutiérrez 2002).
- Maintain adequate canopy cover in Restricted Habitat to allow for nesting, roosting, foraging, and dispersal. For roosting this is generally 40 percent or greater in pine-oak habitat, and 55 percent or greater in mixed conifer (Ganey et al. 1999; May and Gutiérrez 2002).
- In Restricted Habitat, identify "target-threshold habitat" as required by the Recovery Plan (**http://ifw2es.fws.gov/mso/recovery_plan.htm**).
- Manage prescribed fire in order to retain and/or create some snags and downed woody debris.

In PACs

- Designate and protect the 100-acre PAC center from all activity, including any thinning.
- Don't cut trees over 9 inches dbh in PACs.
- Conduct management activities within PACs outside the breeding season (March 1 – August 31).
- Close all unnecessary roads in PACs.
- Minimize recreation within PACs to the extent possible.

Navigating Section 7 Consultation: What Managers Need to Know

Neglecting MSO habitat and even adjacent areas, as has often been done while planning restoration treatments, leaves habitat for this threatened species at risk of stand-replacing wildfire, and in many cases may leave communities in the wildland-urban interface at risk. The Recovery Plan clearly encourages certain treatments within owl habitat. Its recommendations allow varying treatment intensities. Managers have the clear option—and, indeed, a responsibility—to begin flexible and useful restoration treatments in and, especially, around owl habitat. If approached in a manner that considers the recommendations of the Recovery Plan, Section 7 consultation can be conducted efficiently and effectively.

It is advantageous to work with the USFWS through the Section 7 consultation process, and not only because consultation is a legal requirement. Close collaboration will help to ensure that the proposed project minimizes impacts to threatened species wherever possible, and will help to make the project defensible to potential critics. Land managers can navigate through the consultation process successfully, and in a timely manner, if a few important factors and processes are addressed.

Involve FWS personnel early in the project planning. Seek their input early and often. Discuss how the project can best protect owl habitat, and, if appropriate, how management can help create owl habitat over time. Discuss the project in detail over the phone, at face-to-face meetings, and, preferably, in the field. Incorporate USFWS recommendations into the project whenever possible.

Prepare a well-written and biologically sound Biological Assessment. The assessment should address how the project follows the Recovery Plan recommendations. If it does not follow all recommendations, a clear and justified explanation should be provided, along with appropriate conservation measures. Ensure that all PACs are designated and 100-acre centers are drawn for owl territories within and adjacent to the project area. Clearly state the amount and location of all areas designated as Protected and Restricted Habitat and details of owl surveys that have been conducted or are planned. Work with the USFWS to determine the appropriate effect determination so that there are no surprises for either agency. Provide all the details the USFWS will need in order to prepare the appropriate documentation—a concurrence letter or a Biological Opinion. Doing so will allow the USFWS to provide necessary documentation in a timely manner. Additional recommendations are available at **http://arizonaes.fws.gov/Documents/Consultations/GENERALBE.pdf.**

In summary, the most effective way to navigate through the Section 7 consultation process for the MSO is to understand the purpose of the Endangered Species Act, thoroughly read and understand the management recommendations in the MSO Recovery Plan, maintain an active dialogue with USFWS personnel, and attempt to design treatments that assist in the recovery of the MSO while also meeting other goals.

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Cover photograph by Amanda Moors

Series Editor Peter Friederici

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